

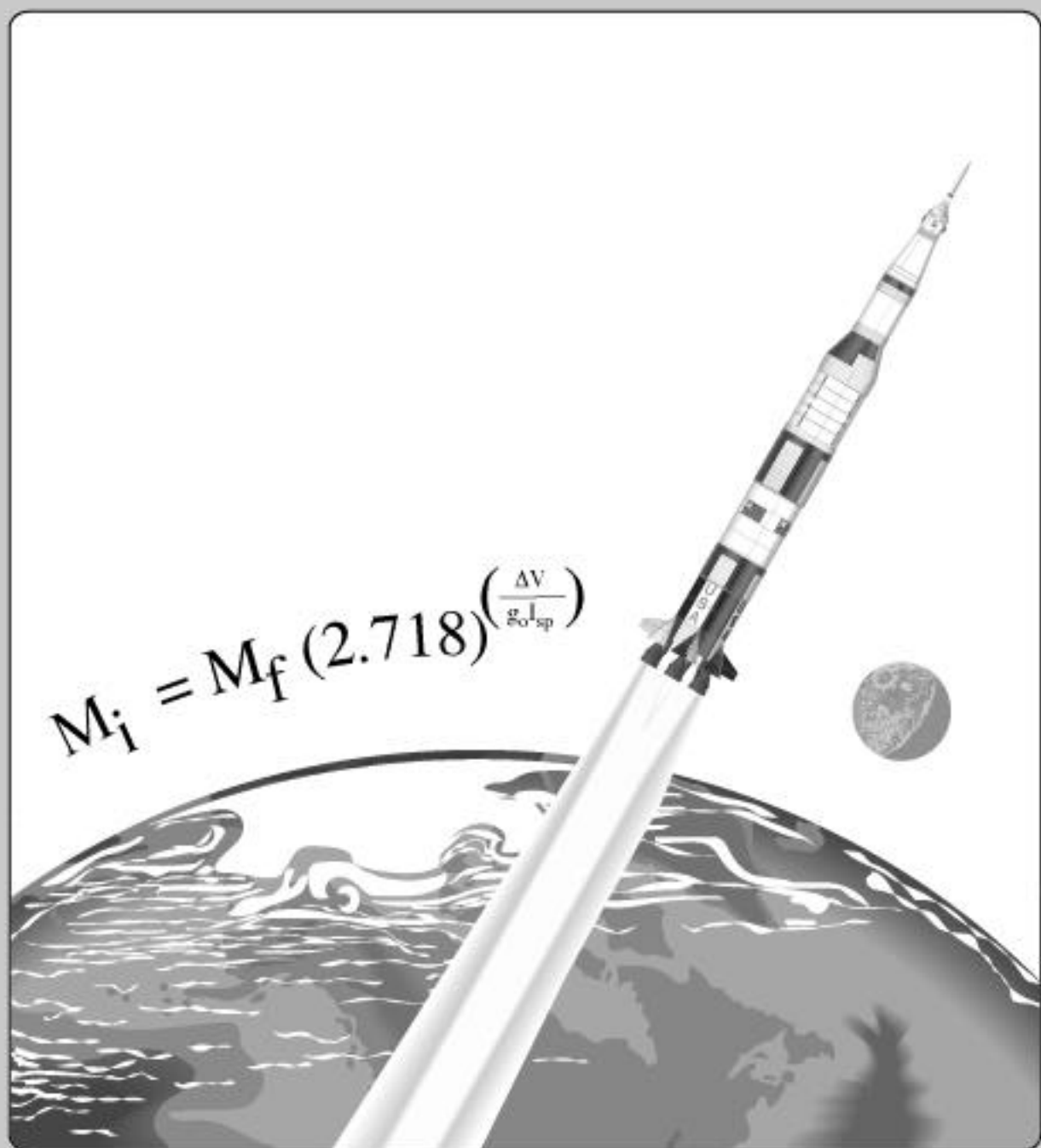


LaRC



ELECTRONIC LESSON:
LEAP BEFORE YOU FLY

OEd



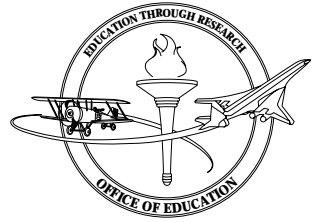


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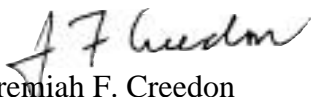
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NASA Langley's National Engineers Week project, now in its seventh year, is an example of the Center's commitment to mathematics and science education and to community outreach. We have a responsibility to encourage and help our young people prepare for life in a technological world and help develop the work force of the future. Providing positive role models is an effective way to capture the interest of students. One way we reach students is in the classroom, with personal visits from our staff. Of course, there are not enough of us to visit as many classrooms as we would like, so alternate methods of sharing the value of a mathematics and science education, as well as good communication skills, are also needed to help us reach as many students as possible.

"CONNECT" is one alternative mechanism for reaching out to the students, especially those we cannot visit personally during National Engineers Week. During the month of February, three 30-minute electronic lessons created by Langley will be distributed through WHRO-TV's ITFS wireless system to school cable networks. Each lesson will target a different group of grades (K-4, 5-8, and 9-12) and will address specific mathematics and science Virginia Standards of Learning (SOL).

The program, which launches Langley's Distance Learning Initiatives, shows the connection between mathematics and science skills taught in the classroom and their application in the workplace. In addition, the lessons show how science, mathematics, and engineering relate to the world around the students and why their studies are important. These lessons will be distributed to school systems on Wednesdays at 10:30 a.m., beginning February 12. The lessons will be rebroadcast on Fridays at the same time.

The Engineers Week program is the single largest outreach effort sponsored by NASA Langley. Last year, 170 employees participated reaching over 24,000 students and teachers within 12 school districts in the Tidewater area. With the introduction of Langley's distance learning programming, and with the collaboration of WHRO, students and teachers from 19 school divisions in Southeastern Virginia and Northeastern North Carolina will be reached.


Jeremiah F. Creedon
Director

LETTER
From NASA Langley's
Director of Education



Project Direction

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WHRO-TV

Special Thanks

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Pete Thomas
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NASA Headquarters Aeronautics
Program Office

NASA Headquarters Office of
Human Resources & Education

Dear Educator:

As one of its four Strategic Outcomes, NASA has accepted the goal of promoting "the pursuit of educational excellence." NASA's vision for education is set forth in the 1996 NASA Strategic Plan:

To promote the pursuit of educational excellence by involving "the educational community in our endeavors to inspire America's students, create learning opportunities, and enlighten inquisitive minds."

The program CONNECT marks the beginning of NASA Langley's distance learning initiatives. It is the goal of Langley's Office of Education to use distance learning media to communicate and disseminate to the educational community instructional programs and materials from NASA's mission to promote excellence in mathematics, science, and technology education.

I sincerely hope you and your students enjoy the video and activities included with each electronic lesson. I invite you to provide us with feedback about this program and any of our other educational products. Included in this guide is an evaluation form. Please take a moment to complete the form and return to us. We will gladly send you some of our outstanding materials, grade level appropriate, upon receipt of your evaluation form.

Sincerely,

Samuel E. Massenberg, Ed.D.
Director, Office of Education
NASA Langley Research Center

ROCKETRY

Lesson Title:

Leap Before You Fly

Airs on WHRO ITFS, Channels 3, 25, 35
February 26, 1997, 10:30 a.m.
Rebroadcast of lesson on February 28,
10:30 a.m.

Subject Area Focus:
mathematics

Science Standards:
Physical Science
-position and motion of
objects
-properties of objects and
materials
**Unifying Concepts and
Processes**
-change, constancy, and
measurement
Science and Technology
-abilities of technological
design

Mathematics Standards:
Problem Solving
Reasoning
Connections
**Numbers and Number
Relationships**
Computation and Estimation
Measurement
Functions

Virginia Standards of Learning:
**Mathematics, All.3: The student
will add, subtract, multiply, divide,
and simplify radical expressions
containing positive rational
numbers and variables and
expressions containing rational
exponents.**

Program Description:

Rockets are the oldest form of self-contained vehicles in existence. Students at every grade level are fascinated by rockets traveling into space.

This problem-solving lesson allows students to calculate how much fuel is required to launch a rocket carrying a payload into space. The students are taken on a field trip to the lab of an aerospace engineer. They are presented with factors involved in launching a rocket. Utilizing the rocket equation-

$$M_i = M_f (2.718)^{\left(\frac{\Delta V}{g_{0isp}}\right)}$$

- students' dreams of rocket flight to distant worlds can be expressed mathematically.

This program provides an exciting and entertaining mathematics lesson which relates to NASA's Human Exploration and Development of Space and Space Science Enterprises. These are two of the four research enterprises which have been established by NASA to implement and communicate its mission to the public. These two Enterprises seek to bring the sphere of space fully within the sphere of human activity.

An important part of the lesson is the **Enterprise Challenge**. Students will have four minutes to complete the challenge. They will solve the rocket equation with given variables. The challenge is for students to determine how much fuel is required to launch a rocket into space.

Before Watching

1. Review with students radical expressions containing rational exponents.
2. Brainstorm possible factors involved in launching a rocket into space.
3. Discuss reasons why staging is an important mathematical concept in launching a rocket into space.

After Watching

1. Consider changing the variables in the rocket equation such as the mass of the rocket, type of fuel, rocket payload, and the rocket's orbiting altitude.
2. Derive one equation from the two-step process to calculate the fuel mass of the **Enterprise Challenge**.
3. Based on the rocket equation, have students discuss design elements that could be used to create a rocket which requires the least amount of fuel to achieve orbit.

Enterprise Challenge

Determine how much fuel is required to launch a rocket into orbit.

Rocket Equation

$$M_i = M_f (2.718)^{\left(\frac{\Delta V}{g_0 I_{sp}}\right)}$$

where

M_f = M_{final} = mass of rocket without fuel

M_i = M_{initial} = mass of rocket with fuel

V = change in velocity

g_0 = acceleration due to gravity

I_{sp} = specific impulse of the fuel

Step 1

Substitute the numbers below for the variables in the rocket equation.

M_f = 200,000 kg

V = 5,600 m/sec

g_0 = 9.81 m/sec²

I_{sp} = 480 sec

Step 2

Solve the following equation.

$$M_{\text{fuel}} = M_i - M_f$$

NASA Educational Resources

The NASA Education Home Page is the entry point for a concise, user-friendly way to learn all about NASA's education programs, products, and services. The page contains:

- a "scrolling line" area for hot topics, application deadlines, and other announcements.
- a brief overview of NASA's Education Program.
- on-line access to current educational information and instructional resource materials.
- information about programs and curriculum support products including a searchable inventory of programs and how to access instructional resource materials and services.
- education points of contact for NASA Headquarters as well as NASA Field Centers.

World Wide Web:

<http://www.hq.nasa.gov/office/codef/education/>

NASA Educational Satellite Videoconference Series is offered as an inservice education program for educators through the school year. The content of each program varies, but includes aeronautics or space science topics of interest to elementary and secondary teachers. NASA program managers, scientists, astronauts, and education specialists are featured presenters. The videoconference series is free to registered educational institutions. To participate, the institution must have a C-band satellite receiving system, teacher release time, and an optional long distance telephone line for

interaction. Arrangements may also be made to receive the satellite signal through the local cable television system. The programs may be videotaped and copied for later use.

For more information, contact:

Videoconference Producer
NASA Teaching From Space Program
308 A CITD

Oklahoma State University
Stillwater, OK 74078-0422

or send an electronic message (e-mail) to:
nasaedutv@smtpgate.osu.hq.nasa.gov

NASA Television features programming that has three program blocks: Education File, History File, and News Video File--repeated at intervals 24 hours a day. Programs feature:

- Space Shuttle mission coverage
- Live special events
- Interactive education videoconferences
- Electronic field trips
- Aviation and space news
- Historical NASA footage

The Education File features programming for teachers and students on science, mathematics, and technology. You and your class can investigate exciting NASA research endeavors in aeronautics, microgravity, planetary sciences, human exploration of space Earth systems, robotics, and more. Educators are welcome to videotape NASA TV. The scheduled times for the Education File are: 2-3 p.m., 5-6 p.m., 8-9 p.m., 11 p.m.-12 a.m., and 2-3 a.m. (EST). For more information, contact:

NASA TV, NASA Headquarters, Code P-2
Washington, DC 20546
Phone (202)358-3572

NASA TV: Spacenet-2, C-Band, T5, Ch. 9,
69 degrees West, 3880 MHz, horizontal
polarization, audio 6.8 MHz

NASA Educator Resource Center Network

To make additional information available to the educational community, the NASA Education Division has created the **NASA Educator Resource Center (ERC) Network**. ERCs contain a wealth of information for educators: publications, reference books, slide sets, audio cassettes, videotapes, telelecture programs, computer programs, curriculum support materials, and educator guides with activities. Because each NASA Field Center has its own areas of expertise, no two ERCs are exactly alike. Telephone calls are welcome if you are unable to visit the ERC that serves your geographic area. A list of the Centers and the geographic regions they serve are listed in the following paragraphs:

Regional Educator Resource Centers (RERCs) offer more educators access to NASA educational materials. NASA has formed partnerships with universities, museums, and other educational institutions to establish RERCs in many states. Educators may preview, copy, or receive NASA materials at these sites. A complete list of RERCs is available through the ERCs or CORE.

NASA Central Operation of Resource for Educators (CORE) was established for the national and international distribution of NASA-produced educational materials in audiovisual format. Educators can obtain a catalogue of these materials and an order form by written request, on school letterhead, to:

NASA CORE
Lorain County Joint Vocational School
15181 Route 58 South
Oberlin, OH 44074
Phone: (216) 774-1051, Ext. 293 or 294

WEB SITE:

Web site for NASA ERCN is:
<http://www.teacherlink.usu.edu/nasa/accessnasa/TRCN.html>

IF YOU LIVE IN:

Alaska	Nevada
Arizona	Oregon
California	Utah
Hawaii	Washington
Idaho	Wyoming
Montana	

Contact:
Mr. Garth A. Hull
Mail Stop 204-12
NASA Ames Research Center
Moffett Field, CA 94035-1000
Phone: (415) 604-5543

NASA Educator Resource Center
Mail Stop T12-A
Moffett Field, CA 94035-1000
Phone: (415) 604-3575

NASA Educator Resource Center Network

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IF YOU LIVE IN:

Connecticut	New Hampshire
Delaware	Pennsylvania
Maine	Rhode Island
Massachusetts	Vermont
Mayland	Washington, DC
New Jersey	
New York	

Contact:

Dr. Robert Gabrys
Code 130
NASA Goddard Space Flight Center
Greenbelt, MD 20771-001
Phone: (301) 286-7206

NASA Educator Resource Laboratory
Mail Code 103.3
Greenbelt, MD 20771-0001
Phone: (301) 286-8570

IF YOU LIVE IN :

Florida	Puerto Rico
Georgia	Virgin Islands

Contact:

Dr. Steve Dutczak
Mail Code PA-EBS
NASA Kennedy Space Center
Kennedy Space Center, FL 32899-0001
Phone: (407) 867-4444

NASA Educators Resource Center
Mail Code ERL
Kennedy Space Center, FL 32899-0001
Phone: (407) 867-4090

IF YOU LIVE IN:

Colorado	North Dakota
Kansas	Oklahoma
Nebraska	South Dakota
New Mexico	Texas

Contact:

Dr. Robert Fitzmaurice
Branch - AP2
2101 NASA Road 1
NASA Johnson Space Center
Houston, TX 77058-3696
Phone: (281) 483-1257

NASA Educator Resource Center
Mail Code AP2
2101 NASA Road 1
Houston, TX 77058-3696
Phone: (281) 483-8696

IF YOU LIVE IN:

Kentucky	Virginia
North Carolina	West Virginia
South Carolina	

Contact:

Dr. Marchelle Canright
Mail Stop 400
NASA Langley Research Center
Hampton, VA 23681-0001
Phone: (757) 864-3313

NASA Educator Resource Center
Virginia Air and Space Center
600 Settlers Landing Road
Hampton, VA 23669-4033
Phone: (757) 727-0900 ext. 757

NASA Educator Resource Center Network

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IF YOU LIVE IN:

Illinois	Minnesota
Indiana	Ohio
Michigan	Wisconsin

Contact:

Ms. JoAnn Charleston
Mail Stop 7-4
NASA Lewis Research Center
21000 Brookpark Road
Cleveland, OH 44135-3191
Phone: (216) 433-2957

NASA Educator Resource Center
Mail Stop 8-1
NASA Lewis Research Center
21000 Brookpark Road
Cleveland, OH 44135-3191
Phone: (216) 433-2017

IF YOU LIVE IN:

Mississippi

Contact:

Dr. David Powe
Manager, Educational Programs
Mail Stop MA00
NASA John C. Stennis Space Center
Stennis Space Center, MS 39529-6000
Phone: (601) 688-1107

NASA Educator Resource Center
Building 1200
NASA John C. Stennis Space Center
Stennis Space Center, MS 39529-6000
Phone: (601) 688-3338

IF YOU LIVE IN:

Alabama	Louisiana
Arkansas	Missouri
Iowa	Tennessee

Contact:

Mr. Jim Pruitt
NASA Marshall Space Flight Center
Huntsville, AL 35812-0001
Phone: (205) 544-8800

NASA Educator Resource Center
U.S. Space and Rocket Center
P.O. Box 070015
Huntsville, AL 35812-0001
Phone: (205) 544-5812

Internet:

The following listing of Internet addresses will provide users with links to URL's related to NASA Education Home Page and rocketry.

<http://www.hq.nasa.gov/office/codef/education/>

<http://www.seds.org/>

<http://www.seds.org/images/>

<http://www.seds.org/galaxy/links-aerospace.html>

<http://ssl.berkeley.edu/>

<http://web.mit.edu/afs/athena/activity/m/mitrs/www/home.html>

<http://www.gbnet.net/orgs/aspire/educate/lvll-3.html>

<http://elvis.neep.wisc.edu/~jfs/need602.lecture28.trajectories.96/need602.lecture28.trajectories.96.html>

NASA Educational Materials

Lithos:

HqL-416 7/96 Space Shuttle *Discovery* Returns From Space
HqL-311 Black Brant XII Sounding Rocket

Fact Sheet:

Clough, J. Scout Launch Vehicle Program
5/92 The Peegasus Space Launch Vehicle

Educational Briefs/Educational Topics:

NASA GSFC/WFF (1988) Wallops- A Guide to the Facility
Scout - 30 Years of Service 1960-1990PMS 018 (KSC) March 1987, Informational
Summaries Countdown! NASA Launch Vehicles and Facilities

Publications:

EG-1996-09-108-HQ Rockets: A Teacher's Guide with Activities in Science,
Mathematics,
and Technology

To obtain resource materials contact the following:

Public Mail Center
1 West Reid Street
NASA Langley Research Center
Hampton, VA 23681

Phone: (757) 864-3293
(757) 864-3297